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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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NOTES ON APPLE ROTS IN WASHINGTON

Harley English[1]

During the past 4 seasons (1939-1943), notes have been taken on the occurrence of different rots of stored apples in Washington. Most of the records have been obtained from the Wenatchee-Okanogan district, but a few lots of fruit from the Yakima Valley have also been examined. Without attempting to make a complete survey in these districts, data were secured on fruit from the following sources: (1) commercial lots showing exceptionally high percentages of decay, (2) specimens brought to the laboratory for diagnosis, and (3) experimental fruits stored primarily for other investigations. Further information on the decay of stored apples in the Wenatchee and Leavenworth districts was obtained from State-Federal Horticultural Inspection Certificates issued at the shipping point.

Most of the apples shipped from North Central Washington during the past 4 years have shown low percentages of fungus decay at the time of shipment. Occasionally, however, fruit with an exceptionally large amount of decay has been encountered. This condition usually was attributable to some climatic factor favorable to infection or to some failure in the handling process, but in some instances the available information did not supply a satisfactory explanation.

DECAY AS REVEALED BY INSPECTION CERTIFICATES

The climate in the immediate vicinity of Wenatchee and that in the Leavenworth-Dryden area probably represent the two extremes of the Wenatchee-Okanogan district. The average annual precipitation in the former district is 8.96 inches, whereas at Leavenworth it is 21.13 inches. As shown in Figure 1 and in Tables 1 and 2, very little of this precipitation, especially that at Wenatchee, occurs while the fruit is on the tree, and it is evident that Leavenworth receives approximately twice as much as Wenatchee during this period. Most of the precipitation that falls on the fruit comes during the harvest period (Figure 1), which ordinarily extends from about the middle of September at Wenatchee until around November 5 at Leavenworth. At Wenatchee the bulk of the Delicious crop ordinarily is harvested between September 20 and October 10 and Winesaps are usually picked between October 5 and 25. At Leavenworth the Delicious harvest ordinarily is completed by October 20 and Winesaps usually are entirely picked by November 5. The 1942 season was rather unique in 2 respects. The fruit was harvested approximately one week later than during the 2 preceding seasons, but not a trace of precipitation occurred during the first 2/3 of the harvest. This permitted nearly all of the apples at Wenatchee and most of the Delicious crop at Leavenworth to be harvested under dry conditions, but a considerable portion of the Winesaps at Leavenworth received rain or snow prior to picking.

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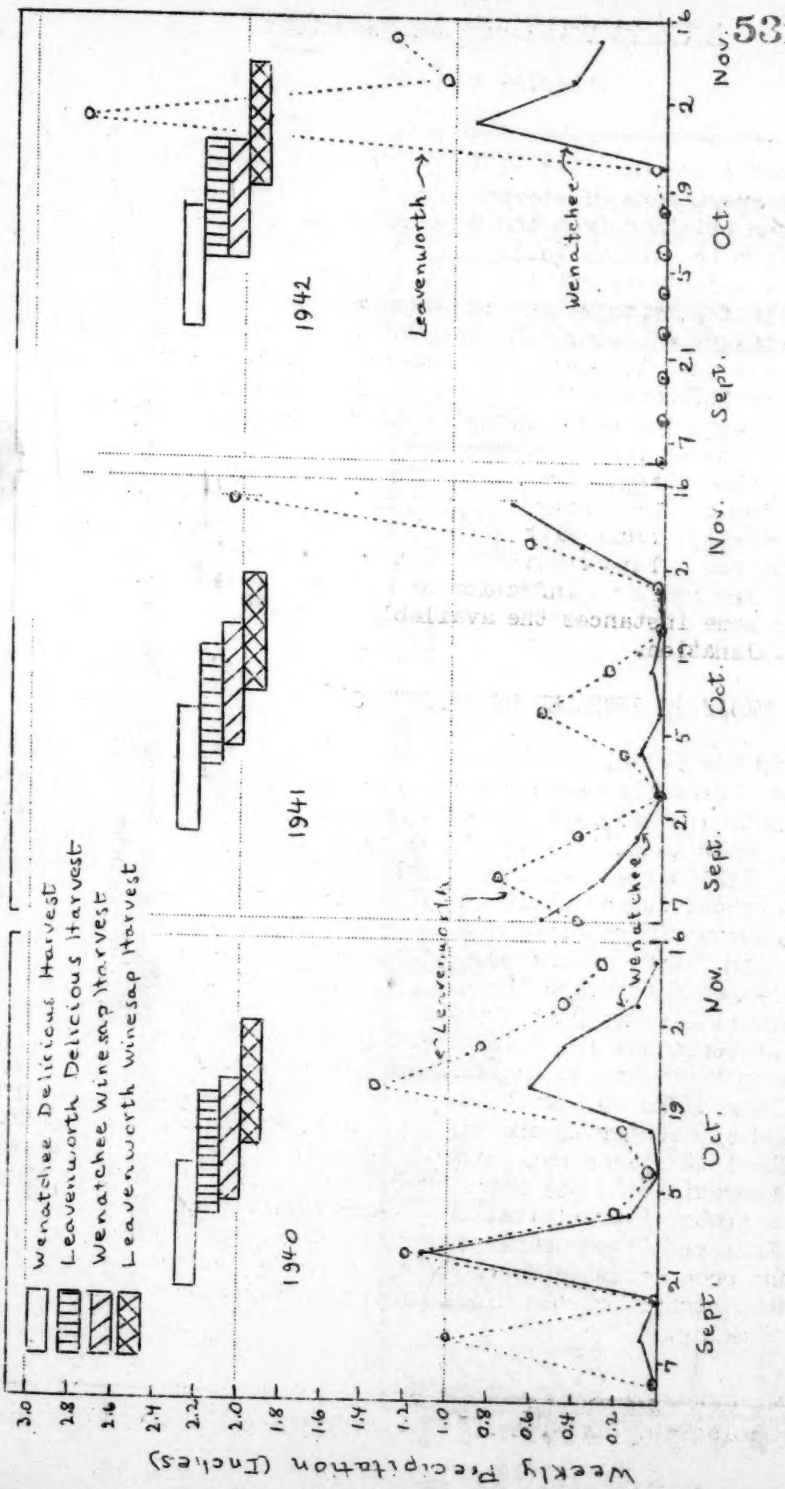

Figure 1.

Weekly precipitation during apple harvest at Wenatchee and Leavenworth.

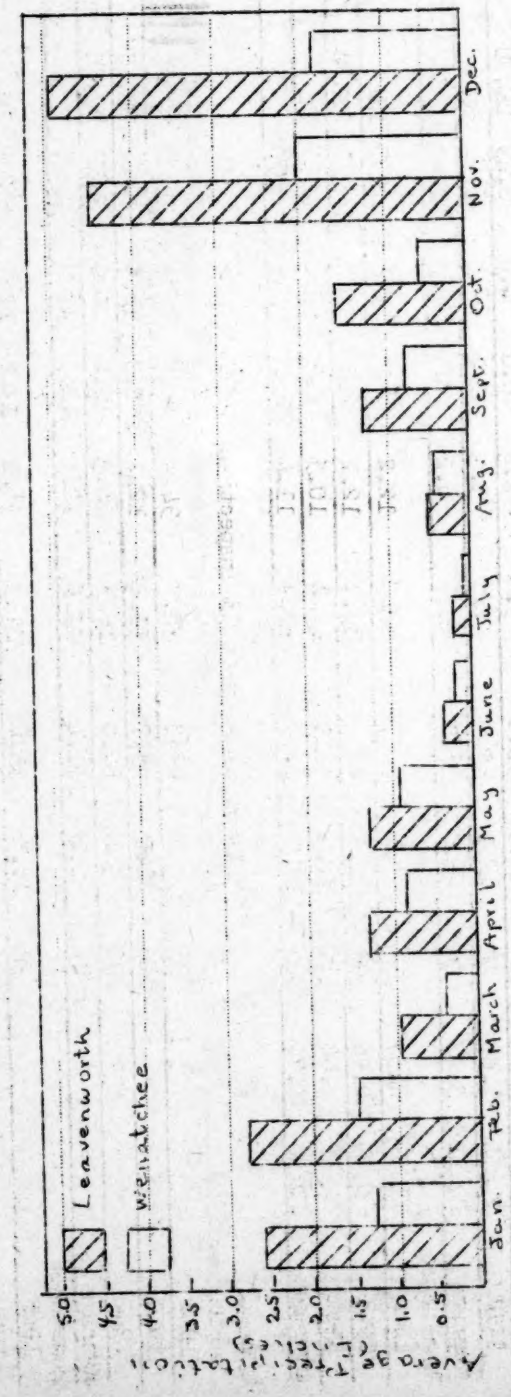

Figure 2.

Average monthly precipitation during the 1940-42 period in the Wenatchee and Leavenworth districts.

Table 1. The Incidence of Decay in Delicious Apples Held in Cold Storage in Two Localities of North Central Washington. Data Taken From State-Federal Horticultural Inspection Certificates. (For footnotes see page 616).

Locality and growing season	Precipitation[a] Annual	Precipitation[a] June to Oct., incl.	No. of lots examined	Percentage of lots in following classes: No decay	.01-.99% decay	1.0-1.49% decay	More than 1.49% decay	Percent with Range of decay[b]	Maximum Percent decay[c]	Average decay (%)	Kind of decay[d]	Infection courts[e]
December 15 - January 15 Inspection												
Leavenworth												
1940	23.71	5.22	86	11.6	40.7	31.4	16.3	7.0	15.0	0.98	BM, U	P, O
1941	21.18	4.62	130	22.3	73.1	3.8	0.8	0.0	4.0	0.43	BM, U	P
1942	21.54	1.86	77	48.0	45.5	2.6	3.9	0.0	5.0	0.34	BM	O, P
Average	22.14	3.27	98	25.9	56.3	11.6	6.2	2.0	8.0	0.57		
Wenatchee												
1940	11.59	2.57	98	9.2	37.8	40.8	12.2	12.2	10.0	0.95	BM	P, O
1941	9.79	2.96	91	25.3	47.3	15.3	12.1	12.1	12.0	0.71	BM, U	P, O
1942	10.35	.66	162	18.5	56.8	14.2	10.5	6.8	13.0	0.70	BM	P, O
Average	10.58	1.70	117	17.7	49.0	21.9	11.4	10.4	11.7	0.78		
March 15 - April 15 Inspection												
Leavenworth												
1940			53	0.0	28.3	37.7	34.0	20.8	20.0	1.48	BM,BE,U	P O
1941			108	1.8	53.7	32.4	12.1	8.3	16.0	0.94	BM, U	O, P
1942			92	5.4	62.0	16.3	16.3	12.0	20.0	0.87	BM, U	O, P
Average			84	2.8	51.4	27.7	18.1	12.3	18.7	1.03		
Wenatchee												
1940			38	10.5	31.7	21.0	36.8	13.2	10.0	1.18	BM	O, P
1941			93	8.6	45.2	31.2	15.0	9.7	10.0	0.95	BM, U	O, P
1942			79	21.5	34.2	24.1	20.2	12.7	13.0	0.94	BM, U	P, O
Average			70	13.8	38.6	26.7	20.9	11.4	11.0	0.99		

Table 2. The incidence of decay in Winesap Apples held in cold storage in two localities of North Central Washington. Data taken from State-Federal Horticultural Inspection Certificates. (For footnotes see page 616).

Locality and growing season	Precipitation[a] Annual	Precipitation[a] June to Oct., incl.	No. of lots examined	Percentage of lots in following classes: No decay	.01-.99% decay	1.0-1.49% decay	More than 1.49% decay	Percent with Range of decay[b]	Maximum percent decay	Average decay (%)	Kind of decay[d]	Infection courts[e]
Leavenworth				December 15 - January 15 Inspection								
1940	23.71	5.22	86	24.4	64.0	7.0	4.6	2.3	6.0	0.50	BM	P, O
1941	21.13	4.62	64	31.2	67.2	1.6	0.0	0.0	1.0	0.36	U	
1942	21.54	1.86	56	19.6	50.0	17.9	12.5	5.4	12.0	0.76	BM, U	O, P
Average	22.14	3.27	69	25.2	61.2	8.3	5.3	2.4	6.3	0.53		
Wenatchee												
1940	11.59	2.57	194	38.1	52.1	8.2	1.6	0.5	8.0	0.39	BM	O, P
1941	9.79	2.96	102	39.2	49.0	6.9	4.9	1.0	12.0	0.45	BM	O, P
1942	10.35	.66	118	74.6	22.9	0.8	1.7	0.0	4.0	0.16	U	P - O
Average	10.58	1.70	138	48.8	43.0	5.8	2.4	0.5	8.0	0.34		
Leavenworth				March 15 - April 15 Inspection								
1940			50	4.0	28.0	38.0	30.0	14.0	37.0	1.42	BM,BE,U	O, P
1941			75	0.0	40.0	45.3	14.7	6.7	15.0	1.14	BM,BE,U	P - O
1942			26	0.0	15.4	19.2	65.4	53.8	30.0	2.66	BM, U	O, P
Average			50	1.3	31.8	38.4	28.5	17.2	27.0	1.49		
Wenatchee												
1940			119	19.3	52.9	18.5	9.3	10.9	16.0	0.74	BM	O, P
1941			146	12.3	59.6	22.6	5.5	6.8	12.0	0.71	BM, U	O, P
1942			115	8.7	61.7	16.5	13.1	11.3	15.0	0.81	BM, U	O, P
Average			127	13.4	58.2	19.5	8.9	9.5	14.0	0.75		

Table 3. The incidence of decay in certain lots of stored[a] apples in North Central Washington. Data based on laboratory study.

Type of lot[b] and examination date	Source of Fruit	Total decay (%) Range	Total decay (%) Average	Infection courts[c] and partition of total decay: Blue mold rot %	Blue mold rot Infection courts	Phialophora rot %	Phialophora rot Infection courts	Bull's-eye rot %	Bull's-eye rot Infection	Gray mold rot %	Gray mold rot Infec-	Miscellaneous rots[d] %	Miscellaneous rots[d] Infection courts
DELICIOUS													
E-3-20-40	Peshastin		0.7	57.9	P,L,C,	31.6	L,P	0.0		2.6	L	7.9	P,L
C-12-10-40	Grant's Orchard	0-27	11.0	100.0	L,P	0.0		0.0		0.0		0.0	
C-12-12-40	Azwell	0-30	14.0	98.3	L,P,C-S	0.0		0.0		0.0		1.7	P
C- 2-26-41	Tonasket	0-18	10.0	68.0	L,P,C	24.0	L,P,W.	0.0		0.0		8.0	L
C- 3-29-41	Dryden	5-22	12.0	53.3	C,L,P	20.0	L,W,C	16.7	L,P,C. W	10.0	L,P	0.0	
E- 4- 8-43	Wenatchee		0.8	56.3	P,Co,C	31.2	Co,L,P	0.0		3.1	C	9.4	C,P
WINESAP													
E- 5-23-40	Peshastin		1.2	83.3	C,P,S	10.0	P,C,W	5.0	C-W-L	0.0		1.7	L
C- 3- 1-41	Leavenworth	0-12	7.0	36.4	L,P	4.6	C	54.4	L,C,W	0.0		4.6	C
C- 3-29-41	Dryden	5-70	21.0	3.4	P,C,L	1.7	L,W	94.9	L,C,W	0.0		0.0	
C- 3-30-42	Wenatchee		6.0	84.0	C,P,S	8.0	P,C,W	0.0		8.0	C,P	0.0	
C- 3-30-42	Orondo		10.0	76.7	C,P-S,W	15.7	P,W,C	1.9	C,P,S	1.3	C	1.9	W
YELLOW NEWTOWN													
C- 3-25-41	Leavenworth	0-17	9.0	2.8	P	0.0		97.2	L,W-C	0.0		0.0	
E- 5- 7-43	Sunnyslope		1.1	59.5	S,P,C	9.5	P	2.4	S	26.2	L,P	2.4	P
ROME BEAUTY													
E- 4- 8-43	Wenatchee		0.6	92.1	P,C,Co,W	5.4	P-Co	0.0		0.0		2.5	P

Footnotes for Table 1.

a. The average annual precipitation at Leavenworth and Wenatchee is 21.13 and 8.96 inches, respectively.

b. "Range of decay" is notation made when the boxes in a lot vary more than 5 in percentage of decay.

c. Greatest percentage of decay for any box of any lot.

d. The abbreviations in this column are as follows: BM - blue mold (principally Penicillium expansum); BE - bull's-eye rot (principally Neofabraea perennans); U - unclassified; they are listed in decreasing order of prevalence.

e. The only infection courts usually listed were punctures (P) and other (O); they are arranged in decreasing order of importance.

Footnotes for Table 2.

a. The average annual precipitation at Leavenworth and Wenatchee is 21.13 and 8.96 inches, respectively.

b. "Range of decay" is a notation made when the boxes in a lot vary more than 5 in percentage of decay.

c. Greatest percentage of decay for any box of any lot.

d. The abbreviations are as follows: BM - blue mold (principally Penicillium expansum), BE - bull's-eye rot (principally Neofabraea perennans), U - unclassified; they are listed in decreasing order of prevalence.

e. The only infection courts usually listed were punctures (P) and other (O); they are arranged in decreasing order of importance, and a hyphen is used between courts of equal prevalence.

Footnotes for Table 3.

a. With the exception of C-3-1-41, which was held in common storage, all lots were from cold storage.

b. An "E" indicates an experimental lot; a "C" similarly designates a commercial lot.

c. The infection courts are listed in decreasing order of their importance, and abbreviations have been used as follows: C= calyx, Co = core, L = lenticel, P = puncture, S = stem, and W = worm (codling moth) injury. Infection courts of equal prevalence have been connected with a hyphen.

d. These rots, listed in the decreasing order of their prevalence, were as follows: Alternaria rot, Stemphylium rot, Dendrophoma rot, Pullularia rot, Cladosporium rot, and a rot caused by a sterile fungus.

The higher elevation and cooler climate of the Leavenworth area, coupled with its later harvest, frequently result in snowfall occurring on some of the fruit, either prior to picking or while the apples are stacked in the orchard awaiting removal to the warehouse. Also, the fruit in this locality is subjected to freezing temperatures more often than is that grown in the lower valley. To determine whether these climatic factors had an influence on decay, the State-Federal Horticultural Inspection certificates and work sheets covering part of the shipments of Delicious and Winesap from the Wenatchee and Leavenworth (including Peshastin and Dryden) areas during the 1940-42 period were consulted. As shown in Tables 1 and 2, certificates covering 2 periods in the storage season were reviewed in making the comparison.

The average decay in Delicious (Table 1) inspected in mid-season (December 15-January 15) was less at Leavenworth than at Wenatchee, but later in the season there was no appreciable difference in the amount of decay in the two districts. The Delicious decay in the Leavenworth area was considerably greater during the comparatively wet harvest season of 1940 than during the other years, whereas at Wenatchee there apparently was insufficient harvest rainfall to have a pronounced influence on the development of storage rots. Only during the 1940 season did the average decay in late shipments of Delicious exceed 1%, but individual boxes occasionally were encountered with as much as 20% infection. It should be mentioned that these figures do not include the initial rot in lots that were unpacked prior to certification and shipment. Relatively large amounts of decay are present in this fruit, but the tonnage of repacked apples is relatively light. The predominant rot in both districts was blue mold (mostly Penicillium expansum), and the only other decay identified by the inspectors was bull's-eye rot (Neofabraea perennans), which assumed some importance in the Leavenworth district in 1940.

On the Inspection Service work sheets, the only infection courts ordinarily listed are "punctures" and "other," the latter including some avenues of infection as stems, calyxes, lenticels, washing injury, insect damage, etc. As shown in Table 1, most of the decay at mid-season in stored Delicious centered at punctures, but later in the storage season the "other" class took precedence. This reversal can possibly be explained by the fact that there was an increase in unspecified rots late in the season and that these rots occurred more frequently at "other" infection courts than at punctures. It is unfortunate that so few of the rots are identified and that the avenues of infection are not more fully specified.

In Winesaps (Table 2) there was less decay in mid-season, both at Wenatchee and Leavenworth, than there was in Delicious, and in the former area the same conditions prevailed in the late-season shipments. At Leavenworth, however, late-stored Winesaps showed considerably more rot than similarly held Delicious. The apparent explanation for this behavior is that Winesaps receive considerably more rain and snow during the harvest period at Leavenworth than at Wenatchee and the Delicious crop frequently is harvested in advance of the heaviest precipitation. It is interesting to note that the 1942 crop at Leavenworth, which received far less precipitation during the June to October period than the crops of the 2 preceding years, developed by far the greatest amount of decay. This can be explained by the fact that a heavy fall of rain and snow occurred during the last half of the Winesap harvest (Figure 1), whereas in 1940 and 1941 the precipitation

was scattered throughout the autumn months. Thus, it appears that the critical precipitation, from the standpoint of fungous decay, is principally that which occurs during the actual harvest period. Rain and the water from melting snow may favor fruit infection by (1) carrying conidia of the bull's-eye rot fungi (and possibly others) from branches to unpicked fruits, or to apples stacked beneath the trees; (2) promoting the production and germination of the spores of fruit-decay fungi; (3) favoring arsenic injury to the fruit (in crops sprayed with lead arsenate); (4) retarding the "healing" of wounds and the "closing" of lenticels; and (5) delaying picking beyond optimum fruit maturity.

Winesap apples shipped from the Leavenworth district late in the storage season had twice as much decay as fruit of the same variety raised near Wenatchee, and the maximum rot in individual boxes was also about twice as great. In 1942 there were nearly 5 times as many lots containing boxes with more than 5% decay at Leavenworth as at Wenatchee. It appears, therefore, that it would be necessary to do more repacking of this fruit prior to shipment from the Leavenworth district than from the lower area. Blue mold rot again predominated in both districts, and bull's-eye rot was important in late-stored fruit during 2 of the 3 seasons. The "other" avenues of infection were more important than punctures in contributing to decay in Winesap apples, which further emphasizes the need--at least from the standpoint of pathology--for the separate listing of the more important infection courts comprised in the category "other" on the inspection work sheets.

DECAY AS REVEALED BY LABORATORY DIAGNOSIS

During the past 4 years, several commercial lots of apples which were being repacked because of excessive amounts of decay were examined and, in addition, a few large experimental lots have been examined for rots at various times. In most instances, the rots could be identified macroscopically, but with some of the more rare types it was necessary to resort to isolation cultures and microscopic study.

The commercial lots that were being sorted and repacked showed average decay ranging from 6 to 21%, and as high as 70% rot was found in one box of one lot (Table 3). In some instances, abundant precipitation during harvest was responsible for the excessive decay; in others, the fruit remained too long in the orchard following picking, or it was not stored at a sufficiently low temperature. In contrast, the experimental apples which were harvested under favorable conditions and promptly cooled to 31°-32° F developed very little decay even when stored until May. The rots encountered in these examinations, and a few additional ones found in other lots of fruit, are discussed in the decreasing order of their importance in the Wenatchee-Okanogan district as follows:

Blue mold rot, largely caused by Penicillium expansum Lk. emend. Thom, but other species of Penicillium occasionally have been isolated. This rot predominated in 11 of the 14 lots listed in Table 3, and in 6 of them it constituted over 75% of the total decay. The most important points of infection were punctures, lenticels, and the calyx basin. Infection in the latter region probably was favored by arsenic injury and washing injury, ordinarily most severe in this portion of the fruit. Invasion via the sepals has frequently been observed in apples exposed to rain or snow during

the harvest period. The infection courts of minor importance included stems, cores (by means of open calyx canals), and worm injuries.

The most serious case of blue mold rot encountered during the past 4 years was in large-size Delicious from an orchard near Brewster. This fruit was being repacked during the first week of November, 1940, and some of the boxes contained as much as 75% decay, nearly all of which was blue mold. At least 50% of the infection was at lenticels, the remainder centering at punctures, calyxes, and in the cavities of stemless fruits. Most of the apples were firm-ripe to ripe, and some of them had remained in the orchard or warehouse for 2 weeks before being placed in cold storage. It is thought that this factor was largely responsible for the excessive amount of decay. Properly handled experimental fruit obtained from this orchard the following season developed less than 1% decay when held until late spring.

Another instance of severe blue mold decay was encountered in a lot of Spitzenburg apples from the Brewster area. Upon their arrival at New York early in November, 1940, the fruit in several carloads had an average of 12 to 13% decay, with individual boxes showing as much as 50%. Most of the decay was found to be caused by blue mold, and lenticels provided entry for the fungus in at least 50% of the infections. One lot of Jonathan apples held loose in cold storage at Wenatchee until December 10, 1940, had approximately 30% blue mold rot, with fully half of it centered at lenticels. The factors contributing to the serious decay in these 2 lots were not readily apparent, although there appeared to be an excessive amount of bruising in the Spitzenburgs, and the Jonathans were somewhat riper than normal.

Bull's-eye rot, principally caused by Neofabraea perennans (Zeller and Childs) Kienholz. Although this decay ordinarily is not serious in the greater part of the Wenatchee-Okanogan district, its common occurrence in the Leavenworth-Dryden area (Tables 1-3), sometimes with devastating results, appears to justify ranking it second to blue mold rot. In 3 of the 14 lots in Table 3, all from the upper Wenatchee Valley, it was more important than blue mold rot, and the serious proportions it can assume under favorable conditions are clearly shown by the Winesap lot from Dryden. This decay rarely appears in cold storage prior to January but when it does become evident in a grower-lot, especially if fall weather conditions were favorable to infection, the fruit is usually marketed immediately. This ability of the rot to appear suddenly and disastrously in late-stored apples has evoked the term "dynamite" which shippers frequently use in describing it. Lenticels appear to be the principal foci of infection, followed in decreasing order by calyxes, punctures, worm (codling moth) injuries, and cracks adjacent to the stem.

An experimental lot of Jonathan apples harvested at Peshastin and held in cold storage showed 2% bull's-eye rot by January 16, 1941. Most of the infections occurred at the calyx, but some were at lenticels, punctures, and codling moth injuries. The Jonathan variety is particularly susceptible to the canker stage of this disease, but the comparatively early harvesting of Jonathans--prior to most of the fall rains--and the consumption of the bulk of the crop by January, usually make the fruit-rot phase relatively unimportant. A commercial lot of Extra Fancy Winesaps grown in the Sunnyslope area near Wenatchee, and held in cold storage, showed 4% bull's-eye rot

when examined April 25, 1943. Two-thirds of the decay centered at lenticels, with the balance principally at calyxes.

Phialophora rot caused by Phialophora malorum (Kidd & Beaum.) McColloch.[2] This decay is frequently called "side-rot" in the East, and until recently the causal organism was placed in the genus Sporotrichum. From the data in Table 3 and from the results of numerous other isolations, there appears to be little doubt that this apple rot ranks third in North Central Washington. In some lots this rot constituted nearly 1/3 of the decay encountered, and in very few samples was it entirely lacking. A high percentage of Phialophora rot in commercial fruit--such as occasionally occurs in the case of blue mold on bull's-eye rot--has never been observed. The disease is widespread in the Wenatchee-Okanogan district, and its incidence appears to be more or less independent of weather conditions. Punctures and lenticels constitute the principal infection courts, followed, in decreasing order of importance, by calyxes, worm injury, and cores (via open calyx canals). In an experimental lot of hydro-cooled Delicious apples at Wenatchee, a serious core-rot condition developed, and P. malorum was the fungus most frequently isolated from the infected tissue. In addition to its occurrence in North Central Washington, Phialophora rot has frequently been encountered in Delicious and Winesap apples from the Yakima Valley, and last year it was found in Yellow Newtowns from the Hood River district of Oregon.

Gray mold rot, caused by Botrytis cinerea Pers. This rot was present in 6 of the 14 lots listed in Table 3, but in none was it responsible for serious losses. Most initial infections occurred at calyxes and punctures, but in stored apples the fungus readily spreads from one fruit to another, apparently by penetrating the lenticels, to produce the condition known as "nest rot". Heavy infection by gray mold appears to be largely dependent upon favorable weather conditions. Several grower-lots of Winesaps from the upper Wenatchee Valley developed excessive amounts of calyx-end gray mold decay in December, 1942. Some boxes had as high as 14% decay and the average was about 3%. Inquiry revealed that snow had fallen on this fruit either before harvest or during the interval between picking and hauling to the warehouse. Winesaps from the Wenatchee Heights district which had been subjected to similar weather conditions also showed serious calyx-end decay in December. In both instances sepals appeared to constitute the initial infection court, the fungus advancing from this tissue into the pulp of the fruit. In some cases a small lesion could be traced to a single necrotic sepal. If lots such as these should be held for late storage, extremely heavy losses undoubtedly would result. It is probable that gray mold rot constituted much of the unclassified decay encountered in Winesap apples in the Leavenworth district in 1942 (Table 2).

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[2] McColloch, L. P. An apple rot fungus morphologically related to a human pathogen. Phytopath. 32:1094-1095. 1942.

Alternaria rot, caused by Alternaria mali Roberts. This decay is the most common of the miscellaneous rots listed in Table 3, but at that it has been found only occasionally on apples held in cold storage. The rot occurs most commonly at mechanical injuries, but is not infrequently found surrounding the calyx, or in the core region. Infection has also been observed at "stings" (codling moth), and in areas affected with sunburn and soft scald. An interesting case of Alternaria rot was found in an experimental lot of Jonathans that had been delayed for 7 days at 65° F and then stored for 2 1/2 months at 45°. Twenty percent of the fruit developed calyx-end rot, 90% of which was caused by A. mali. Fruit similarly delayed but stored at 36° and 31° showed only a trace of Alternaria rot. In another instance, a lot of large-size Delicious that had been held in cold storage for 5 months and ripened at 65° for 1 week showed 32% Alternaria moldy core, but only about 1% actual core rot. The calyx canals were found to be more or less open in a high percentage of these apples. Cold-stored Delicious and Winesap apples from several orchards in the Yakima Valley developed an excessive amount of calyx-end rot by January, 1941, and the most common fungus associated with this decay was A. mali. This fruit was predisposed to infection by an injury to the calyx basin, presumably caused by the application of a toxic insecticidal spray.

Cladosporium rot, caused by fungi of the Cladosporium-Hormodendrum type. Some of the isolates have been identified as C. herbarum Lk., others were similar to the fungus frequently referred to as H. cladosporioides Sacc., and one was distinct from both of these species. These fungi have been found infrequently in apples with moldy core or core rot, and they are the most common invaders of soft scald tissue on Jonathan apples. Mechanical injuries provide the most frequent avenues of infection, but other injuries, such as arsenic burn and sunburn, occasionally promote invasion. Lenticel infection has never been observed. The decay has been encountered in different varieties of apples from several localities in North Central Washington, and also in fruit from the Yakima Valley. It has never been found prior to January on apples held in cold storage, nor have serious amounts of it ever been observed.

Stemphylium rot, caused by Stemphylium congestum Newton and Pleospora fructicola (Newton) Ruehle (the imperfect stage of this latter species belongs in the form-genus Stemphylium). Only rarely has this decay been found in apples held in cold storage in North Central Washington, and it was observed only once in fruit from the Yakima Valley. The lesions centered at punctures, lenticels, and calyxes, and P. fructicola was isolated once from a core rot. This decay evidently causes very little damage to apples in the Wenatchee-Okanogan district.

Pullularia rot, caused by fungi of the Pullularia-Dematium type. These fungi have been isolated from rots centering at lenticels and codling moth stings on a few cold-stored Winesap and Delicious apples in the Wenatchee-Okanogan district late in the storage season, and a calyx-end rot caused by one of the forms was observed in a Delicious apple from Yakima. Another form was isolated in conjunction with a species of Cladosporium from core rots in 2 Delicious apples. In addition to their occurrence in Washington,

one of the species was isolated from shallow, necrotic areas on Yellow Newtown apples collected by J. R. Kienholz in a cold storage plant at Hood River, Oregon, in June, 1943.

Miscellaneous rots. A fungus that has been tentatively identified as a species of Dendrophoma was isolated from core rots in 3 Delicious apples from Wenatchee in the spring of 1943. The fruit had been stored at 31° F since harvest and then had been ripened at 65° for 1 week. The same organism was obtained in March of the preceding year from small lesions surrounding codling moth "stings" in commercially packed Winesaps from Orondo. The pathogenicity of the isolate for apples has been proven by artificial inoculation.

An unidentified species of Fusarium was isolated from 2 core-rot-affected Delicious apples removed from cold storage in February, 1943. The fruit was grown in the vicinity of Wenatchee and was from a lot that had a high percentage of open calyx canals. No other specimens of Fusarium rot were encountered during the past 4 years.

In May, 1941, 3 completely rotted Winesap apples were found in a lot of fruit grown in Mission Creek Canyon and held in cold storage at Cashmere. Isolations yielded a fungus that appears to belong in the genus Sphaeropsis but is markedly different from the common black rot species, S. malorum. The pathogenicity of the fungus to apple fruits has been established, and further studies relative to its specific identity are being conducted.

An interesting decay was found in December, 1942, in some experimental Jonathan apples that had been held at 65°F for 1 week following harvest and for 2 1/2 months thereafter at 45° and 36°. The rot had its inception at the calyx or core of the fruit and, in some instances, almost half of the apple was enveloped. It had a strikingly pungent odor, and pure cultures of the causal organism, a species of Trichoderma, also emitted this odor. The pathogenicity of the fungus to Delicious apples has been established by artificial inoculation.

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, AGRICULTURAL RESEARCH ADMINISTRATION, UNITED STATES DEPARTMENT OF AGRICULTURE.

WEATHER, CROP, AND CEREAL DISEASE CONDITIONS IN KANSAS

C. O. Johnston

May 24 -- 1944 will be remembered in the western Mississippi Valley as the year without a spring. At Manhattan a minimum of 26° F was recorded on the morning of May 6, the lowest temperature ever recorded for that date. Exactly 1 week later the maximum temperature reached 88° F and since that time has remained in the high 80's and low 90's. April 1944 was the coldest, wettest April since 1868. Total precipitation for the month was 6.92 inches, more than 3 times normal.

May has been almost the exact opposite of April. The rains ceased suddenly on May 2 and measurable moisture has fallen on only one occasion since that date. Total precipitation for May to date is 1.3 inches which is below normal. High, drying southwest winds blew night and day during the period May 11 to 19, inclusive, and the soil which was pounded down by heavy rains in April has baked as hard as a brick. The high winds rapidly

depleted surface soil moisture and the leaves of wheat have rolled badly each day for the past 10 days. During the period of high winds there naturally was no dew.

Winter wheat is in a variable condition, depending on local conditions. Much of it is late owing to late sowing to escape hessian fly damage. The cold April also delayed heading somewhat. However, heading is now fairly general in the south-central part of the State and nearly all fields have reached at least the boot stage in the eastern 2/3 of the State. It appears that much of the wheat will be shorter than normal and many fields are thin.

Cereal diseases have been greatly affected by the cold late spring. Only within the last few days has it been possible to find leaf rust [Puccinia rubigo-vera var. tritici] with ease in nearly every field. On May 10 a survey of 3 counties east of Manhattan revealed not a single pustule of rust. On May 18 in a survey of 5 counties west and south of Manhattan, only 2 leaf rust pustules were found. However, by May 18 there were occasional pustules of leaf rust in nearly every field in eastern and south-central Kansas. Now, a sprinkling of primary uredia can be found in nearly all fields throughout the eastern half of Kansas and into Nebraska. No stem rust has been seen as yet and no rust of any kind has appeared on oats or barley, both of which crops are extremely late and poor.

Rust infection in the rust nursery is well established but has increased very slowly. Mildew [Erysiphe graminis] is abundant in that nursery but sparse elsewhere in the State. Perhaps the most abundant cereal disease in Kansas this spring is speckled leaf blotch (Septoria tritici). It is present in every field and very conspicuous in many. In some fields all but the 2 uppermost leaves already have been largely dried up by the blotch. Severe damage undoubtedly will occur in many fields if the disease continues to advance. However, the recent hot, dry, windy spell seems to have retarded further development.

June 3 -- Since the last report, weather conditions in Kansas have been fairly favorable for the development of cereal rusts. Temperatures have been high, strong south winds have frequently blown for several days at a time, dews have occurred with considerable frequency, and heavy showers fell over the period of May 26 to 29. Stem rust of wheat and oats [Puccinia graminis] and crown rust of oats [P. coronata] all have been found in natural infections as far north as Manhattan. Dr. Quisenberry collected stem rust of oats near Newton on May 24 and all 3 diseases were collected at Manhattan on May 29.

Dr. Pady of the Emergency Plant Disease Prevention Project has found traces of stem rust of wheat throughout eastern Kansas and at points as far west as Pawnee County. In all cases only the barest of traces have been found with the exception that a single spot of overwintered infection was found on June 2 in the experimental plots at the agronomy farm at Manhattan. Infection near this spot was heavy.

Leaf rust of wheat is developing fairly rapidly but it seems unlikely that it can develop fast enough to cause severe damage except possibly in late wheat in the western part of the State where infection so far is extremely light.

Most of the wheat in the eastern half of Kansas is fully headed and some fields of early varieties have reached the late milk to soft dough stage.

Midseason to late varieties have just passed blooming. In the western part of the State and especially in the north-central section wheat is extremely late and short. Much of the wheat in Kansas this year will be considerably shorter than usual. The rains of last weekend were general throughout the State, more than 3 inches falling in some of the western counties where the moisture was most sorely needed.

Besides the rusts, several other diseases of wheat are very conspicuous this year. Septoria tritici is abundant everywhere and has already caused some serious defoliation in south-central counties. Loose smut [Ustilago tritici] also seems to be more prevalent than usual. A bacterial leaf spot is fairly widely distributed in the State. This is characterized by small brown lesions surrounded by oval or lenticular yellow haloes. In some fields this disease is abundant. Dr. Pady reports finding traces of scab [Gibberella zeae] and a few fields infected with bunt [Tilletia sp.] in the southeastern part of the State.

DIVISION OF CEREAL CROPS AND DISEASES

OTHER REPORTS ON DISEASES OF CEREAL CROPS

BARLEY DISEASES IN PENNSYLVANIA: Thirteen fields of barley distributed over Blair and Bedford Counties were visited, June 20 to 26. Twelve fields were planted with bearded varieties while one was planted with a beardless 6-row variety, probably Wong. Most of the barley was ripe and ready to harvest.

Leaf rust, caused by Puccinia anomala, was noted in 7 of 13 fields. Usually but a trace of the leaf surface on all culms was affected.

Stripe, caused by Helminthosporium gramineum, was noted in one field where 1.5% of the culms were affected.

Spot blotch, caused by Helminthosporium sativum, was present in most of the fields; from a trace to 15% of the leaf area on up to 100% of the culms was affected.

Scab, caused by Gibberella saubinetii [G. zeae], was noted in 6 of 13 fields. Usually the percentage of heads affected ranged from a trace to 2, but in the one field of Wong barley 30% of the heads were affected; the affected heads contained but 1 to 3 affected kernels.

Loose smut, caused by Ustilago nuda and U. nigra, was noted in 12 of the 13 fields. Its prevalence ranged from a trace to 4.5%

Covered smut, caused by U. hordei [U. jensenii], was found in 10 fields; prevalence ranged from a trace to 7%.

Powdery mildew, caused by Erysiphe graminis, was noted in 10 fields; from a trace to 75% of the leaf area on 100% of the culms was affected.--Leon J. Tyler, Emergency Plant Disease Prevention Project.

BARLEY DISEASES IN THE RED RIVER VALLEY OF MINNESOTA AND NORTH DAKOTA: A survey of small grains was made between June 20 and June 24, the area covered including the Red River Valley area as far north as Warren, Minnesota and Park River, North Dakota. Early-seeded fields of barley in the Red River Valley are heading. Loose smut (U. nuda) appears to be somewhat more prevalent than last year, most fields examined being infected. One field near Ardoch, Walsh County, North Dakota, contained 10% infected heads, the count being based on the number of smutted heads to the total number of tillers. Thus it is possible that infection may be somewhat

higher than the figure given, since many heads were still in the boot. While it was too early to obtain any figure on loose smut infection, most early fields in the Red River Valley appeared to have not less than 2% loose smut.--Ian W. Tervet, Emergency Plant Disease Prevention Project.

CORN DISEASES IN MISSISSIPPI: Surveys during the week ending June 24 were made in the Crystal Springs, Delta, Columbus, and Poplarville areas. Drought appears to be rather severe throughout these sections. Brown spot (Physoderma zeae-maydis) and rust (Puccinia sorghi) were the only diseases observed on corn. Severe spotting by Physoderma was noted near Jackson in Hinds County, Winona (Carrol County), and Porterville. This was mostly in corn that had not flowered as yet. Corn is late this year.--Douglas C. Bain, Emergency Plant Disease Prevention Project.

DODDER ON FLAX IN MISSOURI: One field of flax, in flower, was observed in Pettis County. The plants appeared to be free from infection except in one limited area in which dodder (Cuscuta sp.) was parasitizing the plants.--T. W. Bretz, Emergency Plant Disease Prevention Project. June 12-24.

FLAX DISEASES IN WESTERN MINNESOTA AND EASTERN NORTH DAKOTA: A survey of small grains was made between June 20 and 24, the area covered including the flax-growing region between Morris and Moorhead, Minnesota, and the Red River Valley as far north as Warren, Minnesota, and Park River, North Dakota. The writer was accompanied by H. H. Flor, Division of Cereal Crops and Diseases, Fargo, North Dakota.

While early-sown fields of flax are flowering, there still are many fields in which the seedlings are in the cotyledon or early seedling stage. Much of the flax is chlorotic, a result of the frequent rains and low temperatures.

In earlier reports, it was stated that Crystal flax in southwestern and western Minnesota was not entirely satisfactory, poor stands being obtained in many fields. During the past week, some fields of Crystal flax in the Red River Valley were examined. Good stands were obtained in those fields for which the seed had been obtained from the Crookston Experiment Station of the University of Minnesota, and there were no reports from county agents that Crystal flax was unsatisfactory in the Crookston area of the Red River Valley. However, one field near Warren, Marshall County, Minnesota, was sown with seed from the Morris Experiment Station and the stand in this field, while satisfactory, was somewhat less than normal. It appears that poor stands of Crystal flax have been obtained only with seed from the Morris Station. Not all of the fields sown with the Morris seed were poor, later seedings in western Minnesota generally giving better stands than earlier seedings in the same area. The cause of the poor stands is still obscure: frost, seed- or soil-borne pathogens combined with relatively low viability of the seed, poor soil condition, each may have been partly responsible.

Light infections of flax rust (Melampsora lini) were found on Bison and Biwing in western Minnesota and in the Red River Valley. A few pustules were found on Bison at the Crookston Station and on Bison, Redson, Koto, Royal, and Arrow in plots at the Walsh County Agricultural School, Park River, North Dakota.

A few leaf lesions of pasmo (Sphaerella [Mycosphaerella] linorum) were seen in several fields.

In a few fields, a browning of the tips and margins of the leaves, sometimes associated with necrosis of the growing point, was observed. Little damage was resulting since the injury was confined in most cases to relatively few plants. The cause of this trouble is not known although it may be associated with the attack of some insect.

In one field near Red Lake Falls, Minnesota, a few plants at or near flowering were wilting. The stems of these plants were entirely or partly blanched, the bleaching beginning at the soil line and spreading towards the tip, while the upper leaves retained their normal green color. In severely injured plants, the cortex of the root, just below the ground line, was easily rubbed off. Injured plants were found in clumps, of about 10 plants each, irregularly in the field. Ant hills were usually found in the center of each clump of bleached plants, and these insects may be associated with the injury. Loss from this injury in this field near Red Lake Falls was less than 1%. In a few other fields, occasional clumps of blanched plants were found, loss being a trace in each case.--Ian W. Tervet, Emergency Plant Disease Prevention Project.

HELMINTHOSPORIUM LEAF SPOT OF OATS IN PENNSYLVANIA: Five fields of oats distributed in Blair and Bedford Counties were entered. The plants were heading or just protruding from the boot.

The only disease encountered was that apparently caused by Helminthosporium avenae. From 5 to 40% of the leaf area on 25 to 100% of the culms was affected. It appears that this disease, of unusual occurrence in Pennsylvania, is rather widespread and destructive. Fields almost free from the disease have been noted adjoining fields that were destructively affected.--Leon J. Tyler, Emergency Plant Disease Prevention Project. June 20-2[illegible]

DISEASES OF OATS IN GEORGIA: A statewide survey of small grain diseases was made during the week of May 8 to 13. The crops this year, as a whole, are probably above the average. Oats are especially good.

Forty-eight fields of oats were examined. In south Georgia and as far north as Athens, Helminthosporium avenae (identification by D. A. Preston) leaf spot was found in all fields examined. In some fields damage was severe. Crown rust (Puccinia coronata) was found in only one field (near Swainsboro) and here there was only a trace. Loose smut (Ustilago avenae) was found in most fields but never more than a trace to 3%. Covered smut (U. levis) [U. kolleri] had caused a 20% damage in one field near Millen. --G. M. Stone, Emergency Plant Disease Prevention Project.

OAT DISEASES IN MISSOURI: During the period June 12 to 24, small grain fields in central, west-central, and western Missouri were surveyed for the incidence of disease. During a portion of this period the survey was conducted with Mr. Ivar Twilde, State Barberry Eradication Leader, Bureau of Entomology and Plant Quarantine.

South of the Missouri River the oats were in the milk stage of development and north of the River the fields, in general, were in flower, although a few late-planted fields were in the joint to boot stage.

Stem rust (Puccinia graminis) was noted in over 90% of the fields. The prevalence ranged from a trace to 100%, averaging about 50%, and the severity of infection ranged from a trace to 3%. Crown rust was found in practically every field, ranging in prevalence from a trace to 100%. The sever[illegible]

ity of infection ranged from a trace to 20%, averaging about 3%.

Loose smut infection was observed in 65% of the fields, from a trace to 5% of the heads being affected, averaging approximately 2.5%. A trace of covered smut was noted in 3 of the fields examined.

Blast (nonparasitic) was found in about half of the fields, ranging from a trace to 3%.

Leaf spotting of the foliage other than that caused by leaf rust was 100% prevalent in all fields, affecting in some instances as much as 50% of the foliage. Examination of collected material reveals that most of this spotting is due to a Helminthosporium (probably H. avenae). In a number of fields in the western section south of the Missouri River, many of the lesions showed the development of anthracnose (Colletotrichum graminicolum) fruiting bodies.

Halo blight (Phytomonas [Pseudomonas] coronafaciens) was present to the extent of a trace in all areas except in the western counties north of the Missouri River, where vigorous infection was noted in a number of fields, affecting all plants and approximately 50% of the foliage.--T. W. Bretz, Emergency Plant Disease Prevention Project.

RYE DISEASES IN PENNSYLVANIA: During the period June 20 to 26, small grains were examined for diseases, mostly in Blair, Bedford, and Somerset Counties. Four fields of rye were examined. Leaf rust, caused by Puccinia dispersa [P. rubigo-vera var. secalis], was noted in all fields and on most of the culms; from a trace to 5% of the leaf area was affected. A trace of ergot, caused by Claviceps purpurea, was noted in all fields.--Leon J. Tyler, Emergency Plant Disease Prevention Project.

RYE DISEASES IN MISSOURI: During the period June 12 to 24, small grain fields in central, west-central, and western Missouri were surveyed. Only 2 fields of rye were observed, these in the soft to hard dough stage of development. Leaf rust was 100% prevalent in both fields, showing a severity of 10% and 20% respectively. Stem rust amounted to a trace in one field; in the other the prevalence was 75%, the severity a trace. A trace of ergot and scab (Gibberella saubinetii) [G. zeae] infection was noted in one of the fields.--T. W. Bretz, Emergency Plant Disease Prevention Project.

WHEAT DISEASES IN PENNSYLVANIA: Eight fields of wheat distributed over Blair and Bedford Counties were visited. Most of the wheat was in the soft dough stage. A trace of stem rust was noted in 4 fields. The pustules seen were mostly on the sheath and stem. Leaf rust, caused by Puccinia triticina [P. rubigo-vera var. tritici], was noted in all fields; from a trace to 10% of the leaf area on 100% of the culms was affected. Loose smut, caused by Ustilago tritici, was present in all fields; its prevalence ranged from 0.5 to 8% with an average of 2.6%. Scab was observed in 7 of the 8 fields; prevalence ranged from a trace to 0.5%. Powdery mildew was present in all fields but it was destructive in only 4, with 5 to 15% of the leaf area affected. The Helminthosporium disease caused by H. sativum was observed in 3 fields. A trace to 5% of the leaf and stem area on 25 to 100% of the culms was affected.--Leon J. Tyler, Emergency Plant Disease Prevention Project. June 20-26

DISEASES OF WHEAT AND OATS IN THE DENTON, TEXAS, AREA: Diseases did not become a serious factor in the fall-sown grain. Soft wheat in the eastern

part of the country was rather fully covered with leaf and stem rust as it matured but reduction in yield was light. Crown rust and stem rust did not appear early enough to materially injure fall oats but spring-sown oats are being injured now. In experimental plantings such susceptible varieties as Fulwin, Tennex, and Wintok are killed by crown rust and will make little grain. Very valuable information was obtained in the extensive spring-sown, head-row nursery. Resistance of the resistant rows is very marked, with susceptible rows being killed by crown rust in many instances.--I. M. Atkins, Division of Cereal Crops and Diseases. June 10.

DISEASES OF WHEAT OBSERVED IN MISSOURI: During the period June 12 to 24, small grain fields in central, west-central, and western Missouri were surveyed for the incidence of disease. During a portion of this period the survey was conducted with Mr. Ivar Twilde, State Barberry Eradication Leader Bureau of Entomology and Plant Quarantine. With the exception of the east-central area near St. Charles and the extreme southwestern portion of the State, this survey covered the major winter-wheat producing sections of Missouri.

The crop has matured very rapidly during the past 10 to 14 days. The majority of the fields south of the Missouri River were in the hard-dough stage. Many fields were sufficiently ripe to harvest and some were being cut. A few fields were still in the soft-dough stage of development, however. North of the Missouri River most of the fields were in the soft to hard dough stage, although a few were mature and were being harvested or were ready to harvest.

Stem rust was prevalent in all fields and in most instances practically 100% of the plants were infected. In the western portion of the State, south of Kansas City, some fields were observed in which the prevalence did not exceed 10%, however. The severity of infection was extremely variable, ranging from a trace to as much as 20% in a few fields. The over-all average for severity was slightly less than 5%. Stem rust probably has caused some damage in a few, severely infected fields. However, in considering the area surveyed as a whole, it appears that the crop was sufficiently mature to escape serious damage.

Leaf rust was also present in all fields. In the majority of fields the prevalence was 100% and the severity of infection ranged from a trace to as much as 50%, averaging approximately 15%.

Loose smut is undoubtedly the most important disease factor in accounting for losses in wheat this season. Infection was noted in every field, ranging from a trace to as much as 25% in some fields, averaging 7.5% for all fields examined.

Scab head blight ranged from a trace to as much as 30% in one field, averaging slightly more than 3%.

Glume blotch (Septoria nodorum) infection was noted in 75% of the fields. In general the extent of infection amounted to only a trace, although in a few fields as many as 75% to 90% of the heads showed from a few to many glumes affected. The average number of heads affected for all fields was 12%.

In many fields from a trace to as many as 20% of the plants had ripened prematurely, with the heads containing shriveled grain or no grain at all. Examination of the basal portions of such plants revealed the presence of the anthracnose organism (Colletotrichum graminicolum) or a Fusarium sp. at the lower nodes. Anthracnose appeared to be associated with this trouble

more commonly than the Fusarium.

In one field a trace of ergot was observed.

In 2 fields a trace to 3% of the heads showed symptoms characteristic of black chaff (Phytomonas translucens var. undulosa) [Xanthomonas translucens f. sp. undulosa].--T. W. Bretz, Emergency Plant Disease Prevention Project.

DISEASES ON WHEAT AND OATS IN IOWA: On a trip in the southwestern part of Iowa, with Dr. H. C. Murphy, Dr. G. C. Kent, and Prof. L.C. Burnett, we found halo blight to be probably the worst disease on oats and scab the worst on wheat. Rusts are spreading but it does not appear now that they will actually reduce the yields in Iowa.

Septoria nodorum appears to be general on wheat, infection ranging up to 10%.--Edgar F. Vestal, Emergency Plant Disease Prevention Project. June 24.

STEM RUST ON WHEAT IN NORTH DAKOTA AND MINNESOTA: A survey of small grains was made between June 20 and June 24, from Morris to Moorhead, Minnesota, and in the Red River Valley area as far north as Warren, Minnesota, and Park River, North Dakota. A trace of stem rust was seen on Marquis wheat in plots at the North Dakota Agricultural College, at Fargo, June 20. Dr. L. R. Waldron of the North Dakota College reported that the first pustules had been seen a few days earlier, this being one of the earliest recorded appearances of stem rust at Fargo. At the Crookston, Minnesota, Experiment Station a very few pustules were found on Marquis on June 22. Stem rust was not seen on any other variety at these stations nor in any wheat field.--Ian W. Tervet, Emergency Plant Disease Prevention Project.

SEPTORIA NODORUM ON WHEAT IN NORTH DAKOTA, AND SOME MISCELLANEOUS NOTES: What appears to be an unseasonably early outbreak of Septoria nodorum developed on leaves of spring wheat in some fields near Mandan, North Dakota, during the first week of June. The abundant spotting developed during a very warm period following a rain, which approached 2 inches. The lesions are circular to confluent, pale buff to ashy, and contain pale brown globose pycnidia about 90 to 130 μ in diameter. Most of the spores are as yet only one-septate, 18-24 x 2.8-4 μ. Since the spotting first appeared the weather has become cool and moist and the wheat crop is making heavy leaf growth although it has not quite started to shoot.

The weather during the first week in June, already mentioned, favored also a considerable development of the halo blight [Pseudomonas coronafaciens] of oats and the chocolate bacterial spot [P. coronafaciens var. atropurpurea] of bromegrass and wheatgrasses. Bacterial leaf spotting of field peas also is common in some plots.--Roderick Sprague, Division of Cereal Crops and Diseases, Northern Great Plains Field Station, Mandan, North Dakota. June 8.

REPORTS ON SOME DISEASES OF LEGUMES

PEANUT DISEASES IN TEXAS: Leaf spot (Mycosphaerella arachidicola) was becoming serious in fields of bearing plants near Dilley, Frio County, and was present in Atascosa and Wilson Counties. Root rot (Phymatotrichum omnivorum) was serious in a field near Dilley. Approximately 0.5% of the plants were dead on June 16. Southern blight (Sclerotium rolfsii) was ob-

served occasionally in peanut fields in Frio, Atascosa, and Wilson Counties. --George E. Altstatt, Emergency Plant Disease Prevention Project. June 8-20.

DISEASES ON SOYBEAN IN MISSISSIPPI: Traces of charcoal rot (Sclerotium bataticola) were found in 2 large fields in Madison and Yazoo Counties. No Diaporthe sojae could be found on the infected plants. Bacterial pustule (Bacterium [Xanthomonas] phaseoli var. sojense) was widespread on plants in one field near Yazoo City.--Douglas C. Bain, Emergency Plant Disease Prevention Project. June 19-24.

REPORTS ON POTATO LATE BLIGHT, AND OTHER DISEASES OF POTATO, AND DISEASES ON TOMATO, EGGPLANT, AND PEPPER

Reports quoted by Dr. I. E. Melhus in his letter to members of the Upper Mississippi Valley Late Blight Committee state that no late blight (Phytophthora infestans) has been found in the field as yet in Iowa or Wisconsin, where the disease had been reported in cull piles. In Iowa diseased vines were found June 20 in some cull piles that had not shown late blight the preceding week. No late blight was found in a survey of more than 30 commercial fields in the Platte and Loup Valleys in central Nebraska.

According to Dr.W.E.Brentzel, also quoted by Dr. Melhus, a rather sketchy survey of potato fields was made in the Red River Valley in North Dakota from Fargo to Grand Forks and west to Northwood in Grand Forks County, the territory in which late blight is most likely to be found first in that State. Growing potatoes were found in a number of dump piles examined. "Blight was not found in any of the territory north of Fargo", he reports, but "In one field southwest of Fargo, in a corner of Cass County, a blighted condition was observed, which, I think, might be the beginning of Phytophthora. However, no spores were found and I was unable to induce sporulation on collected samples." (June 24).

Reports on late blight on potato in New York and Georgia and on tomato in Mississippi are given below.

POTATO DISEASES IN NORTHERN VERMONT: The period June 19 to 22 was spent in the company of Mr. H. L. Bailey, Director of Plant Pest Control, Vermont State Department of Agriculture, looking at potato fields in northern Vermont. Two areas were visited, one the Hardwick-Essex Junction area of Lamoille and Chittenden Counties, the other the Lunenburg-Guildhall area of Essex County.

Rhizoctonia (Corticium vagum) [Pellicularia filamentosa] seemed to be universally present as affected plants were found in each of the 16 commercial fields examined. Prevalence in the 16 fields ranged from 30% to 100%. In the Hardwick-Essex Junction area the average prevalence of plants infected with rhizoc in 6 fields was 70%, and in the Lunenburg-Guildhall area 76% in 10 fields. Except for 2 or 3 fields where infection was light, rhizoc was moderate to heavy in severity, with stem severing quite common.

One field of what appeared to be Chippewas was found in Essex Junction which, in addition to 60% rhizoc, also had a count of 9 to 10% leaf roll (virus), and a trace of blackleg (Erwinia atroseptica) [E. phytophthora].

Throughout northern Vermont volunteer plants in second-year potato fields present a problem this year. Snow coverage throughout the winter was adequate to preserve old tubers in the field, and now in some fields volun-

teers are numerous in the rows as well as between the rows.--Robert C. Cassell, Emergency Plant Disease Prevention Project.

POTATO DISEASES IN NEW YORK: (Reports from Weekly News Letter, June 26). Late Blight on Long Island -- Three days of cold and rain have made conditions ideal for blight on the North Fork of Suffolk County. Active late blight was noted near Southamptom and the disease could easily be of epiphytotic proportions. More late blight was reported near Bridgehampton. --G. Gyrisko.

Leaf Roll in Allegany County -- Leaf roll was found in one field. Dr. M. F. Barrus estimated that 50% of the plants were affected.--V. C. Stevenson.

LATE BLIGHT AND BACTERIAL DISEASES OF POTATOES IN GEORGIA: During the period ending June 17, an intensive survey was made of potatoes in the north-central mountain section. Forty-four fields were visited. Late blight was found in all "valley" fields. While infection was general, damage was comparatively light except in 3 fields where the estimated damage was 25%. Only a trace to no blight was found in the fields located near the top of the mountains.

Bacterial wilt (Phytomonas [Pseudomonas] solanacearum) (identification by Lillian C. Cash, U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering) was found to be quite a serious problem in this section. Conditions seem to be unusually favorable for the development of this disease. Comparatively large areas in several fields were found where practically 100% of the plants were wilted. Losses from brown rot in these cases will be extremely heavy.

Only a few isolated plants with bacterial ringrot (Corynebacterium sepedonicum) were found.--G. M. Stone, Emergency Plant Disease Prevention Project.

BACTERIAL RING ROT OF POTATO IN TEXAS: Bacterial ringrot was found on potatoes grown from infected seed by Dr. R. D. Watson of the Texas Agricultural Experiment Station Substation No. 2, Tyler.--G. E. Altstatt, Emergency Plant Disease Prevention Project. June 8-20.

TOMATO DISEASE SURVEY IN PENNSYLVANIA: During the period June 20 to 26, tomato fields in Blair and Bedford Counties were examined for diseases. As usual, 100 plants selected at random and well distributed in each field entered were examined. Information concerning sources of transplants, transplanting dates, agencies supplying the plants, etc., were obtained from the growers. The information obtained parallels that summarized in earlier reports from Pennsylvania.

Alternaria stem canker (Alternaria solani) was found in 23 of a total of 31 tomato plantings examined. The prevalence of diseased plants ranged from none to 21%. Of all the plants examined in the 2 counties, 8.09% exhibited one or more stem cankers. It is probable that this figure is low due to the fact that frequently some cankers are below the soil level at the base of the stem. Such cankers escape notice because the surveyor is not at liberty to pull plants, or to dig away the soil from the stem base and roots in order to make an examination. Based only upon plantings which exhibited the disease, 11.5% of all plants examined in such fields in Blair County were infected and 10.9% of those in Bedford County. The percentages

of stem-cankered plants bearing leaf lesions were 12 and 38.3 for the 2 counties, respectively. Usually, leaf lesions were located on the underside of the petiole, and/or on the tip leaflets of the first leaves.

As shown in previous reports the source of transplants was important in relation to prevalence and severity of Alternaria stem canker.

Twenty-one of 24 plantings set with southern (mostly Georgia certified and a few North Carolina-grown) transplants exhibited stem-canker, while 3 of 7 set with Pennsylvania-grown transplants exhibited the disease.

Of the plants examined that originated in the South, 8.4% exhibited stem-canker, while 6.9% of the Pennsylvania-grown transplants examined were affected. The rather poor quality of the Pennsylvania-grown transplants seen in Blair and Bedford Counties is doubtless due to the fact that these were mostly home-grown plants produced without the benefits of all prescribed disease control measures. In earlier reports it was shown that Pennsylvania-grown transplants generally were of higher quality, i. e., were nearly disease-free, than those originating in the South, but it is also true that the northern-grown transplants were produced mostly by commercial growers of transplants who, in most cases, diligently followed prescribed disease control practices.

Tomato mosaic was noted in 4 of 31 plantings; its prevalence ranged from 1 to 3%. The highest percentages of mosaic were noted in northern-grown transplants.

Wilt, probably caused by Pseudomonas solanacearum, was noted in 11 of 31 plantings. Usually no more than 1 to 2% of the plants were diseased but counts in one field in Blair County indicated 12 to 15% with wilt. Wilt was seen only in fields set with southern-grown transplants.

Generally, the planting dates for Blair and Bedford Counties were about one week later than those previously given for counties lying to the eastward. Again, the tomato variety Rutgers was about the only one used in commercial fields.--Leon J. Tyler, Emergency Plant Disease Prevention Project.

DISEASES ON TOMATO AND OTHER SOLANACEOUS PLANTS IN MISSISSIPPI: Surveys during the week ending June 24 were made in the Crystal Springs, Delta, Columbus, and Poplarville areas. Drouth appears to be rather severe throughout these sections. Garden crops need rain.

Early blight (Alternaria solani) appeared to be the worst disease noted on Tomato plants in the Crystal Springs area. There is, and will continue to be considerable loss of fruit because of sunscald. Fruit spot (Phytomonas [Xanthomonas] vesicatoria] was found in trace amounts. Late blight (Phytophthora infestans) was noted on leaves of plants in 2 fields north of Crystal Springs. It is possible that there was loss of fruit because of this disease. Approximately 3% of the plants in a 1-1/2 acre field near Brookhaven had bacterial wilt, and traces were noted in gardens near Poplarville. Near Crystal Springs, occasional fruits with nailhead spot (Alternaria tomato) were found. A trace of mosaic (virus) was noted in a test plot at the Crystal Springs Experiment Station.

Leaf spot (Phomopsis vexans) was observed in trace amounts in 2 Eggplant fields near Crystal Springs.

On Peppers near Crystal Springs and at the Experiment Station traces of Fusarium wilt (F. annuum) were found. A small amount of leaf spot (Xanthomonas vesicatoria) was also noted at the Experiment Station. In another field of about one acre 3% of the plants were infected by Sclerotium rolfsii.--Douglas C. Bain, Emergency Plant Disease Prevention Project.

PHYTOPHTHORA BLIGHT OF PEPPER IN LOUISIANA: Blight caused by Phytophthora capsici was found in one field of about one acre near Pontchatoula in Tangipahoa Parish. About 20% of the plants had been killed by the disease and another 10% or more were infected. The disease was found on leaves, stems, and fruits. This is the first time it has been found in Louisiana.--Douglas C. Bain, Emergency Plant Disease Prevention Project. June 19-24.

SOME DISEASES OF ONIONS GROWN FOR SEED IN LOUISIANA

E. C. Tims

The growing of onion seed in the southern part of Louisiana is limited by certain troubles that develop principally during the period of blossoming and seed setting. Three stalk rot diseases,-mildew (Peronospora destructor), purple blotch (Macrosporium [Alternaria] porri), and black stalk rot associated with Macrosporium parasiticum [Alternaria parasitica],-probably cause most of the loss in seed onions here. But there are other troubles also. During the past season a serious root rot condition was observed in some fields, often associated with pink root (Phoma terrestris). A blasting of seed heads was also prevalent this year, causing serious losses in some cases.

During the past season the losses to onion seed growers ranged from about 15% to practically 100%. Many gardeners grow a few plants for seed every year, others may have enough to produce a pound or more of seed. Some of these growers lost every plant this year before any seed were formed. The larger growers had fields up to 3 to 4 acres in size. Some of them had serious losses--as high as 75 to 90%; others had as low as 10 to 20%. The losses were so variable that an accurate estimate is very hard to make. But the losses from various stalk rot troubles were quite serious on most farms.

The stalk diseases began to develop this year between April 15 and 25 during a prolonged period of wet weather. The onions were in full bloom and many heads had seed set when the worst disease outbreaks occurred. Most of the severely diseased stalks fell over within a few days after infection, and some falling occurred during the remainder of the season until the seed were harvested during the latter part of May and early June. The seed stalks severely affected early in the season failed to set seed entirely or set only a few. Many stalks that became diseased after the seed were well set fell over and the seed rotted on the ground.

The stalk rot diseases include 3 apparently different sets of symptoms, but they often overlap each other, and all of them may occur on the same seed stalk. Purple blotch has well-defined symptoms which are definitely associated with the long-spored form, Macrosporium [Alternaria] porri. This disease was widespread this year but in general caused little damage. Mildew (Peronospora destructor) is considered the most serious disease of onion in the State. In 1943 it almost wiped out the onions in certain areas of the State[1], but this year mildew was of minor importance in most onion fields. Traces of the disease were found in one seed field where the black stalk rot, associated with M. parasiticum [Alternaria parasitica], was

[1] E. C. Tims. Diseases of onion, shallot, and garlic in Louisiana during the 1942-43 season. PDR 27: 281-283. 1943

quite destructive. But this year's observations did not give a very clear picture of the relative importance of the Peronospora and Macrosporium. During wet weather the black stalk rot developed so quickly with such a luxuriant black growth of the fungus over the stalks as to obscure any other fungus that might have been present. The worst infected fields were too isolated this year for daily observations to be made such as would be necessary for a thorough study of the onion stalk rot troubles.

A root rot condition evidently caused some dying of onion seed stalks. This year many of the diseased stalks had very poor root systems, most of the roots being decayed and sloughed off when the plants were pulled out of the ground. Pink root (Phoma terrestris) was widespread on onions grown for seed this season. Another evidence of root rot is the fact that in general the seed stalks died out much worse in the lower, more poorly drained areas.

The blasting of onion seed heads is a serious problem in certain seasons. Losses in one or two fields ran as high as 40 to 50% this year from failure of the heads to fill, even when no definite stalk disease was present. Many strong, vigorous seed stalks produced heads that set practically no seed. There were all gradations between complete failure to set seed and normal, full heads. The cause of this blasting is obscure. Most of the trouble was apparently just a failure of the blossoms to set seed.

LOUISIANA EXPERIMENT STATION, BATON ROUGE

VARIOUS REPORTS ON DISEASES OF VEGETABLE PLANTS

BEAN MOSAIC IN GEORGIA: Quite a few "patches" of green beans were observed in the north-central mountain area of the State. The beans were in early bloom and were unusually free from disease. In fact, the only disease observed was an occasional mosaic (virus) plant.--G. M. Stone, Emergency Plant Disease Prevention Project. June 17.

DISEASES OF BEAN AND LIMA BEAN IN MISSISSIPPI: Surveys during the week ending June 24 were made in the Crystal Springs, Delta, Columbus, and Poplarville areas. Drought appears to be rather severe throughout these sections.

Web blight (Rhizoctonia microsclerotia) was found to be common and destructive in fields around Brookhaven and Hazelhurst on Beans. Stem canker (R. solani) was observed in a 1-acre field near Brookhaven. Considerable damage was apparent. Traces of southern wilt (Sclerotium rolfsii) were also found in this field.

Pod blight (Diaporthe phaseolorum) was noted in considerable amounts on pods and leaves of Lima Beans in gardens near Poplarville.--Douglas C. Bain, Emergency Plant Disease Prevention Project.

POD BLIGHT ON LIMA BEAN IN LOUISIANA: Pods sent from Houma by Dr. E. V. Abbott were heavily spotted by Diaporthe phaseolorum.--Douglas C. Bain, Emergency Plant Disease Prevention Project.

DISEASES OF CUCURBITS OBSERVED IN TEXAS: Downy mildew (Pseudoperonospora cubensis) was causing slight damage to commercial varieties of cantaloup at the Winter Haven Experiment Station in Zavalla County, and was severe on plants in trial plots near Robstown, Nueces County. No downy mildew was observed on cantaloups in Maverick County and only a trace in

Chambers County.

Powdery mildew (Erysiphe cichoracearum) was seen affecting cucumbers, squash, and cantaloups in Zavalla, Maverick, Nueces, and Galveston Counties. --George E. Altstatt, Emergency Plant Disease Prevention Project. June 8-20.

ROOT ROT OF OKRA IN TEXAS: Better than 2% of the plants in a planting of okra in Maverick County were killed by Phymatotrichum omnivorum. This was the second year of cropping on this land since it was cleared.--George E. Altstatt, Emergency Plant Disease Prevention Project. June 8-20

ONION DISEASES IN TEXAS: Southern blight (Sclerotium rolfsii) and pink root (Phoma terrestris) were causing slight damage in a planting of Australian Brown onions in Wilson County.--George E. Altstatt, Emergency Plant Disease Prevention Project. June 8-20.

ROOT ROT OF PEAS IN NEW YORK: In Oneida County root rot is prevalent and it is expected that the crop will not be quite so good as last year.--Wm. M. Barry, Weekly News Letter. June 26.

PEA DISEASES IN PENNSYLVANIA: Eight fields of peas in Somerset County were visited on June 24. A trace of root rot, probably caused by Rhizoctonia [solani], was noted in all fields. In some fields there were small spots, usually in pocketed areas, from which the plants were missing or that had failed to make appreciable growth. Pulling some of these stunted plants from the soil revealed that the roots were rotted, and examination of a few of the rotted roots showed that both Aphanomyces and Fusarium were present. Pod spots were not encountered.--Leon J. Tyler, Emergency Plant Disease Prevention Project.

DISEASES ON VARIOUS SPECIAL CROPS

COTTON DISEASES IN MISSISSIPPI: Surveys during the week ending June 24 were made in the Crystal Springs, Delta, Columbus, and Poplarville areas. Drought appears rather severe throughout these sections, but apparently cotton has not suffered much as yet. As stated in other reports, cotton is late this year. Flowers were observed in only a few small fields which apparently had been planted early. Wilt (Fusarium [oxysporum f.] vasinfectum) was found in trace amounts in all of the fields surveyed in the Delta area. None was seen around Columbus and Macon. Angular leaf spot (Bacterium [Xanthomonas] malvacearum) was noted in trace amounts in both the Delta and Columbus areas. In one large field near Belzoni in Humphrey County, 2 areas of about 20 feet in diameter each had been struck by lightning which, of course, killed the plants.--Douglas C. Bain, Emergency Plant Disease Prevention Project.

COTTON DISEASES IN TEXAS: Angular leaf spot is general in all cotton areas, and has been found severe in certain fields in Atascosa, Fort Bend, and Maverick Counties. In Maverick County, a large field was noted in which infection had apparently spread to the tips of all the lower leaves when the field was flooded with water sometime earlier. Infection in this field will cause the loss of many of the lower leaves.

Cercospora leaf spot (C. althaeina) was encountered occasionally, but not in sufficient quantity to be damaging.

Root rot (Phymatotrichum omnivorum) was killing cotton in Maverick, Wilson, Karnes, and Nueces Counties. In numerous fields, areas of dead plants were increasing rapidly in these counties, and present indications are that losses will become more serious as the season progresses.

Fusarium wilt was serious in some fields in Fort Bend County, but was found rather infrequently elsewhere.--George E. Altstatt, Emergency Plant Disease Prevention Project. June 8-20.

LEAF SPOT OF STOCK BEETS (MANGELS) IN TEXAS: A small block of mature stock beets in Maverick County showed a heavy infection by Cercospora beticola. Since the plants were mature, the disease probably had little effect.--George E. Altstatt, Emergency Plant Disease Prevention Project. June 8-20.

REPORTS ON DISEASES OF FRUIT CROPS

FRUIT DISEASES IN NEW YORK: (Reports from Weekly News Letter, June 26). Some secondary Apple scab [Venturia inaequalis] infection has occurred in several orchards in Rockland County, according to W. J. Clark, and many growers have applied lime-sulfur to burn out the lesions. In Orleans County, G. G. Maier reports scab as appearing in increasing amounts on the fruits in many orchards. Next to the McIntosh variety, Baldwins seem to be most severely affected in Monroe County, according to R. S. Granger. In Ulster County C. C. Gillette states that scab is more serious on fruit than it was last year, although there is less leaf infection.

Fireblight [Erwinia amylovora] is appearing in apple orchards along the lake in Monroe County.

Peach leaf curl [Taphrina deformans] is defoliating trees in Orleans County orchards that did not receive the dormant spray.

Cherry leaf spot [Coccomyces hiemalis] is appearing in unsprayed orchards in Orleans County; it is general and has serious potentialties in Monroe County unless it can be checked; infection so far appears light in Wayne County, according to C. G. Small, although it can be found in many orchards.

Brown rot [Monilinia fructicola] is being controlled with difficulty in early sweet cherries in Monroe County, and some can be found in Rochester peaches.

PEACH DISEASES IN MISSISSIPPI: Scab (Cladosporium carpophilum) and brown rot (Sclerotinia [Monilinia] fructicola) were common on fruits in orchards around Crystal Springs and Laurel. In one orchard near the first-named town, brown rot infection was estimated to be over 40%. Some farmers in this area and at Poplarville have not been able to obtain wettable sulfur for spray at the local stores. Frosty mildew (Cercosporella persicae) was found to be commonly distributed on leaves of seedling trees near Poplarville.--Douglas C. Bain, Emergency Plant Disease Prevention Project.

BROWN ROT ON STONE FRUITS IN TEXAS: Brown rot (Sclerotinia americana) [Monilinia fructicola] was causing severe damage and loss of plums in an orchard near Lindale. A large percentage of the fully ripened fruit as well as the near ripe fruit were infected. A comparatively light infection was also observed on green peaches in the same orchard.--George E. Altstatt, Emergency Plant Disease Prevention Project. June 8-20.